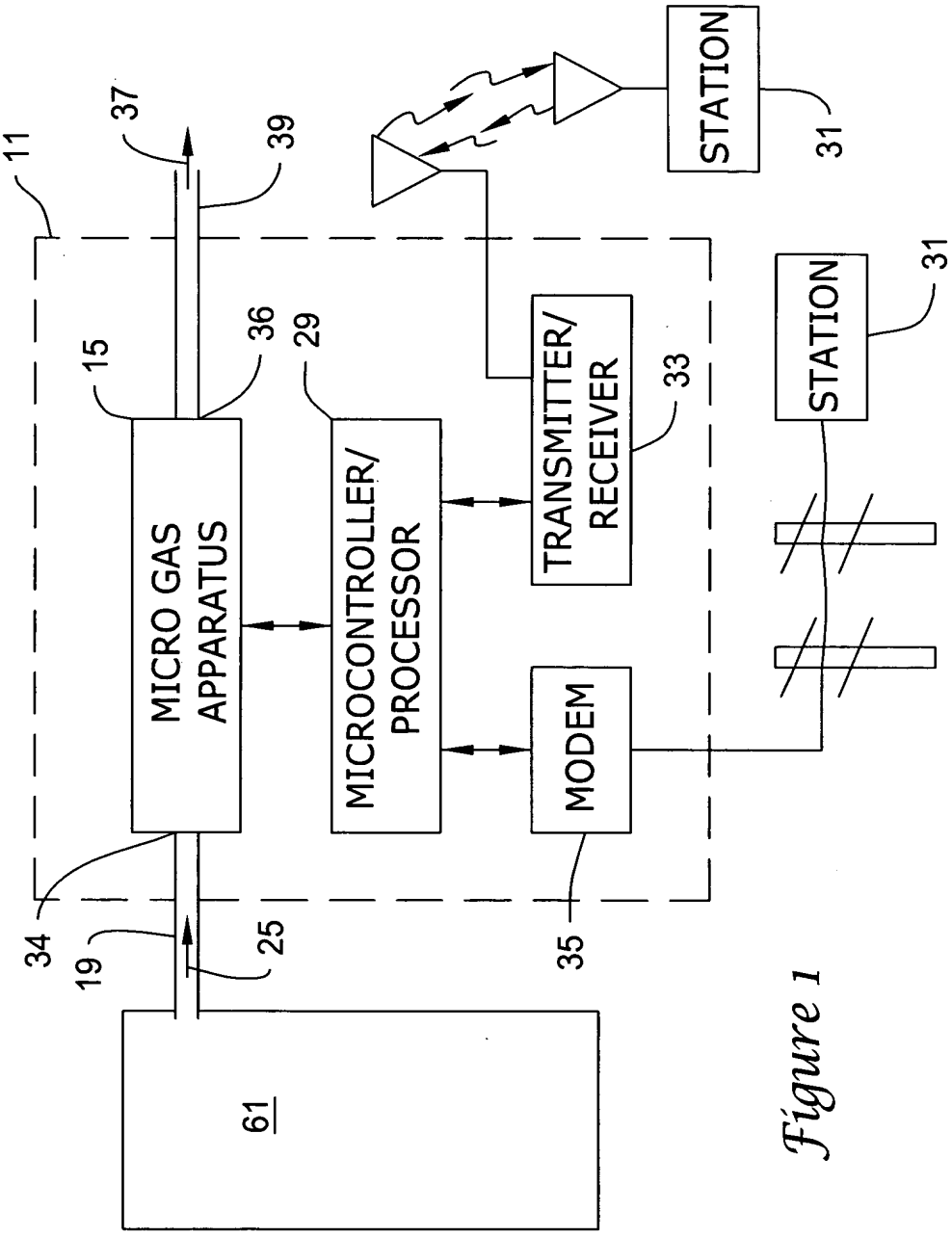

Figure 1

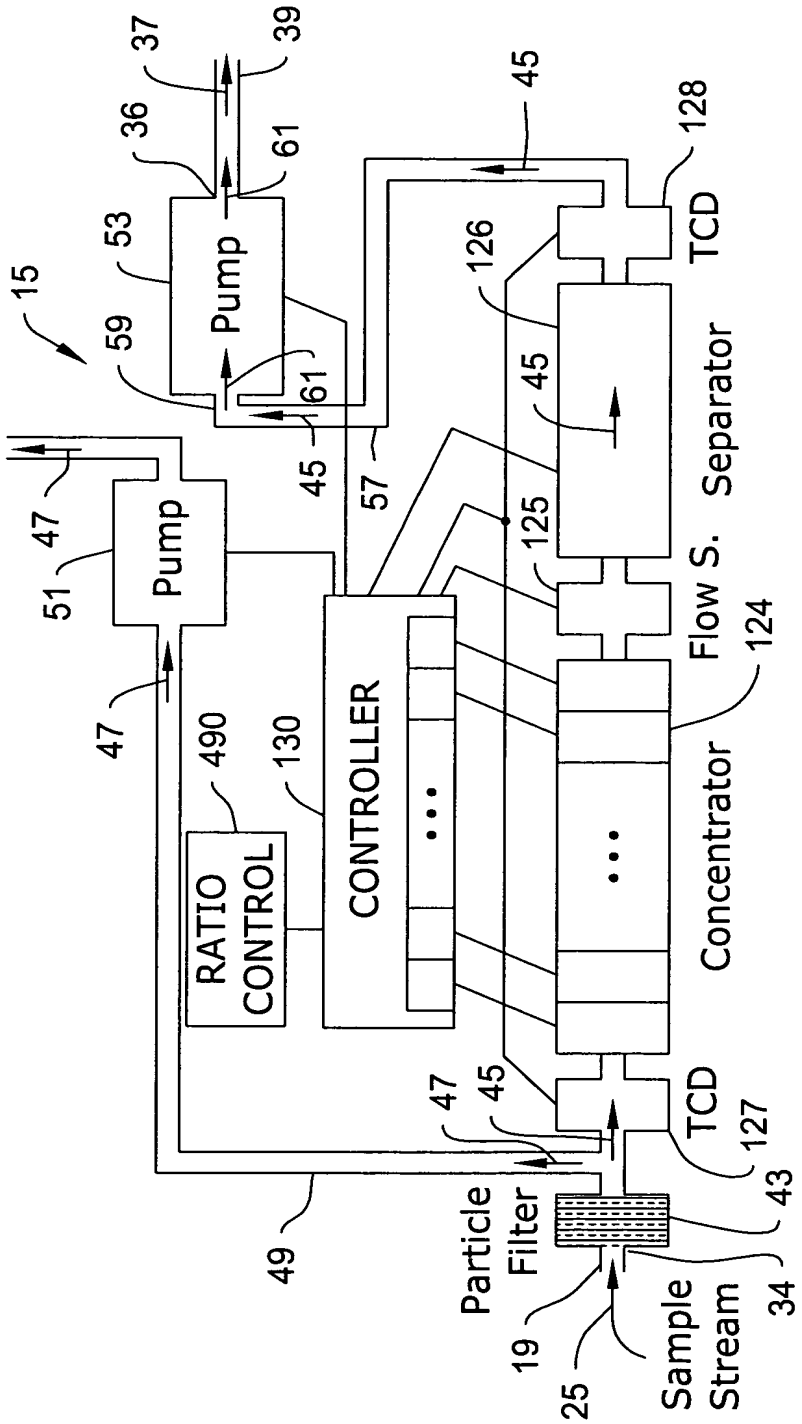
15
37
39
36
61
53
Pump
59
61
45
57
45
128
TCD
126
45
Separator
125
Flow S.
124
Concentrator
TCD
127
43
47
51
Pump
47
490
130
RATIO CONTROL
CONTROLLER
47
45
49
Particle Filter
19
25
Sample Stream
34

Figure 2

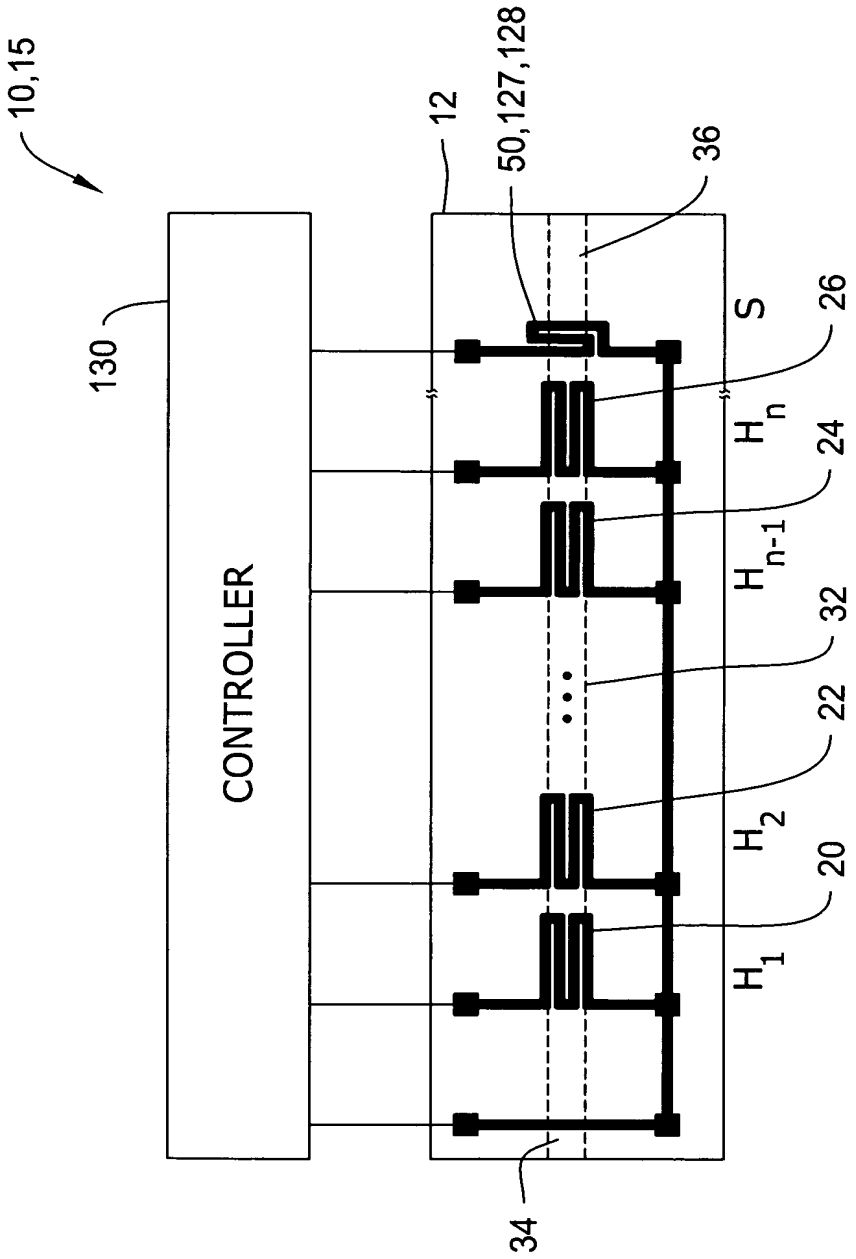
10,15
12
50,127,128
36
130
CONTROLLER
S
26
H_n
24
H_{n-1}
32
22
H_2
20
H_1
34

Figure 3

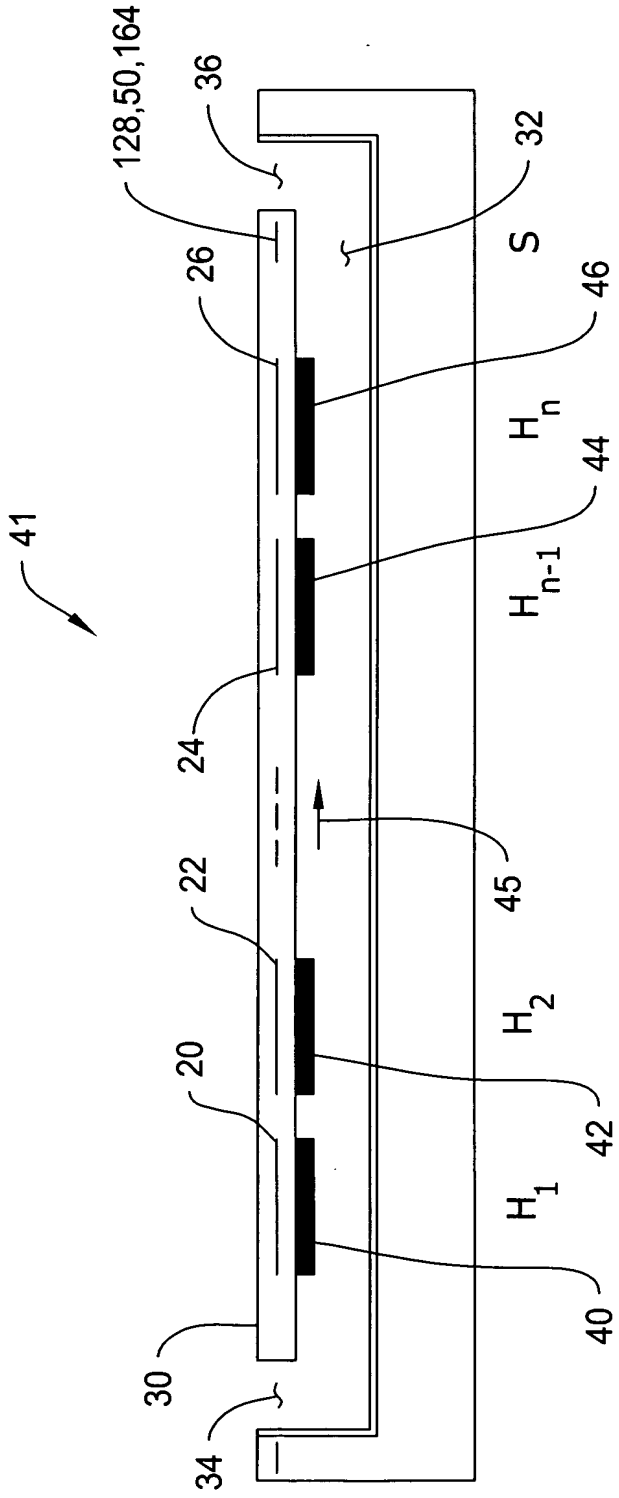

Figure 4

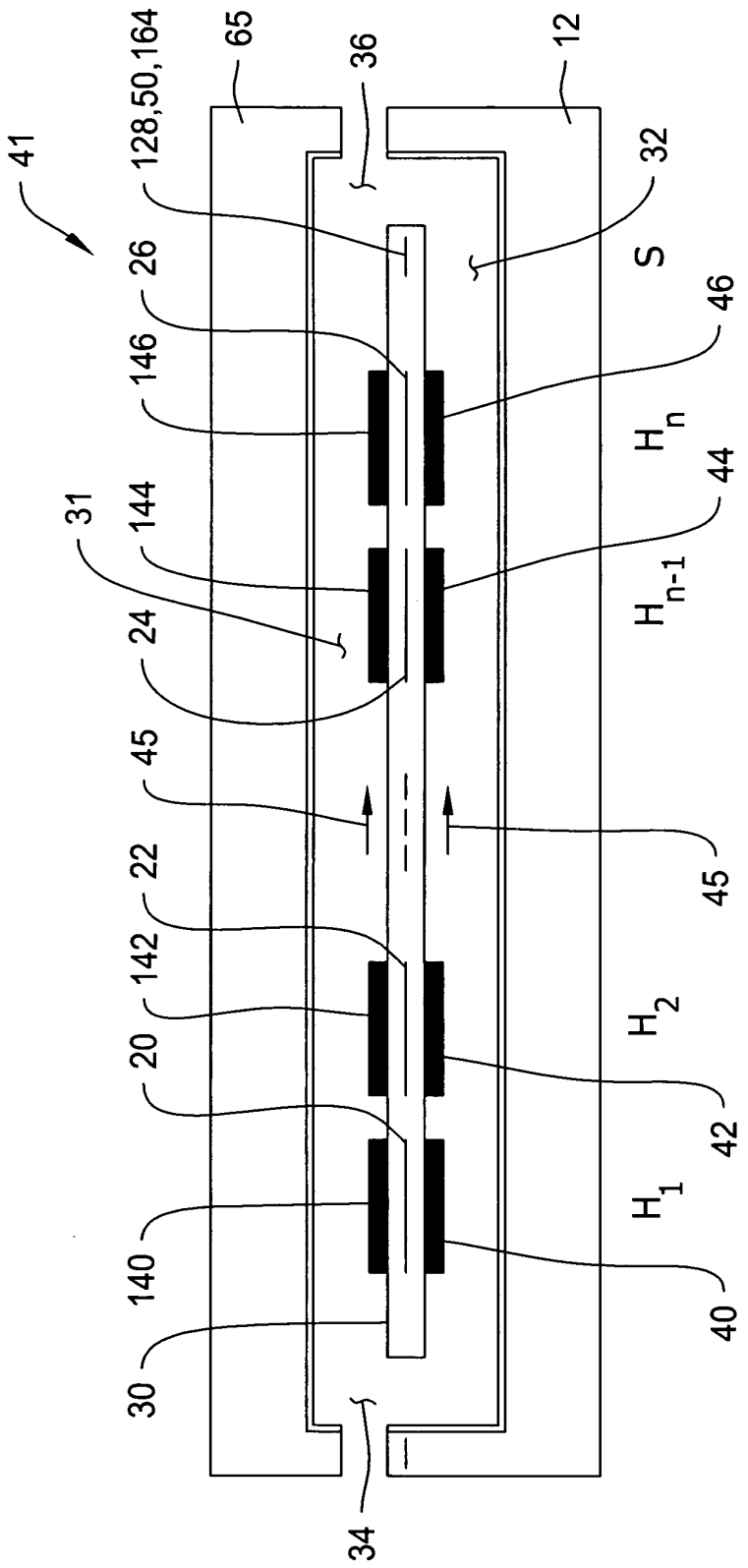
41
128,50,164
65
36
12
32
S
26
146
46
H_n
144
44
H_{n-1}
31
24
45
45
22
142
H_2
20
42
140
H_1
40
30
34

Figure 5

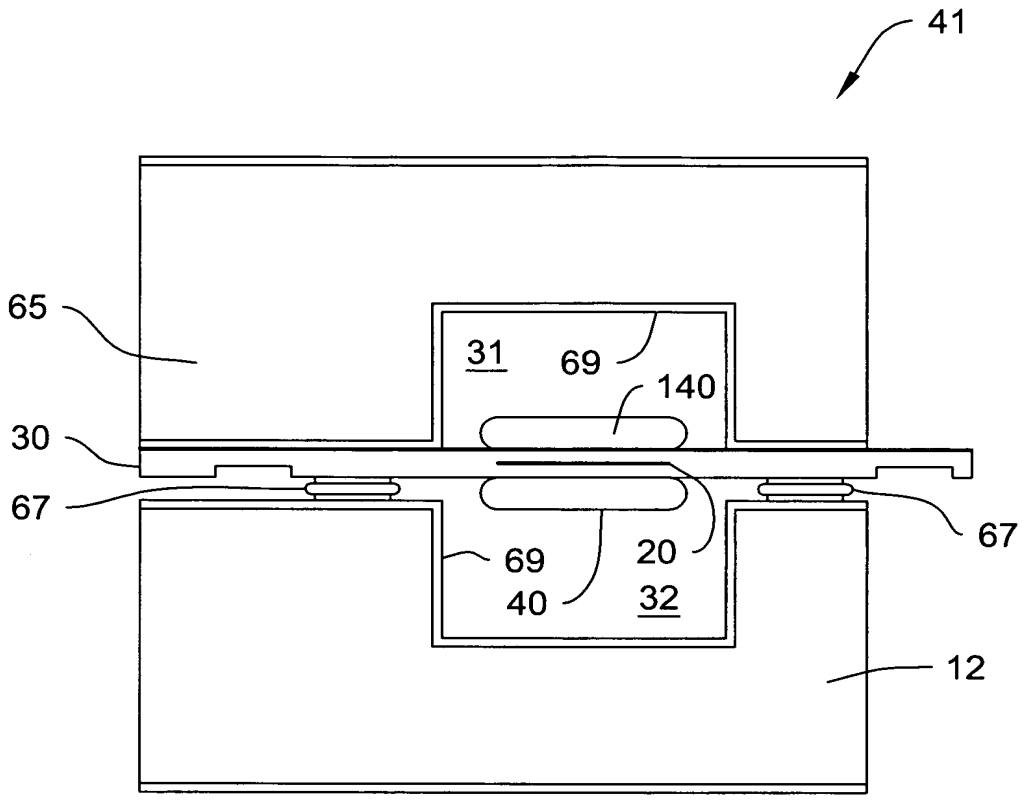

Figure 6A

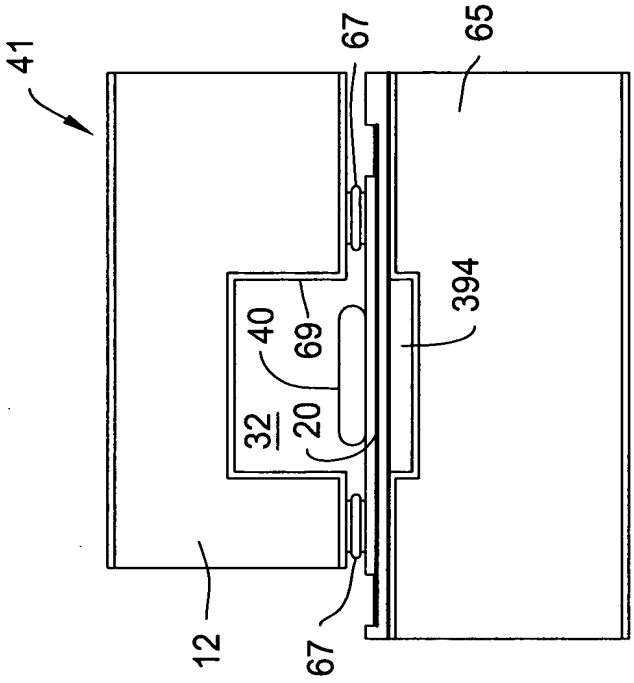

Figure 6C

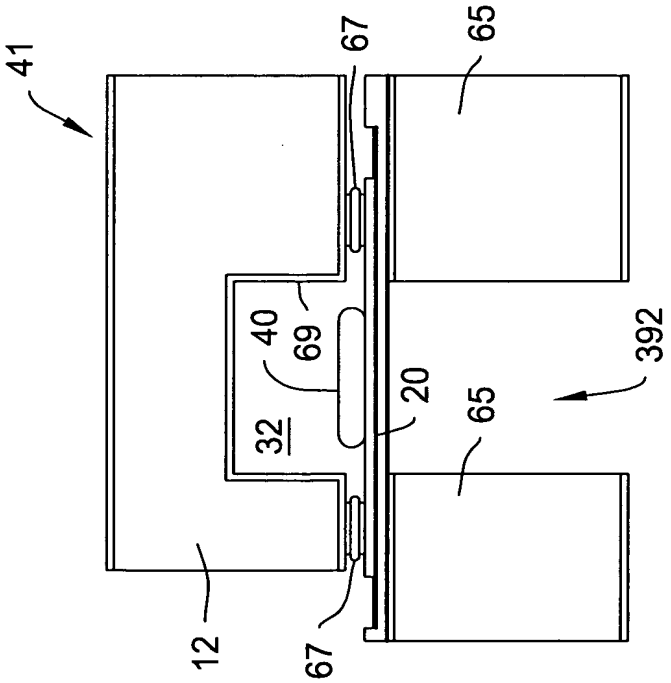

Figure 6B

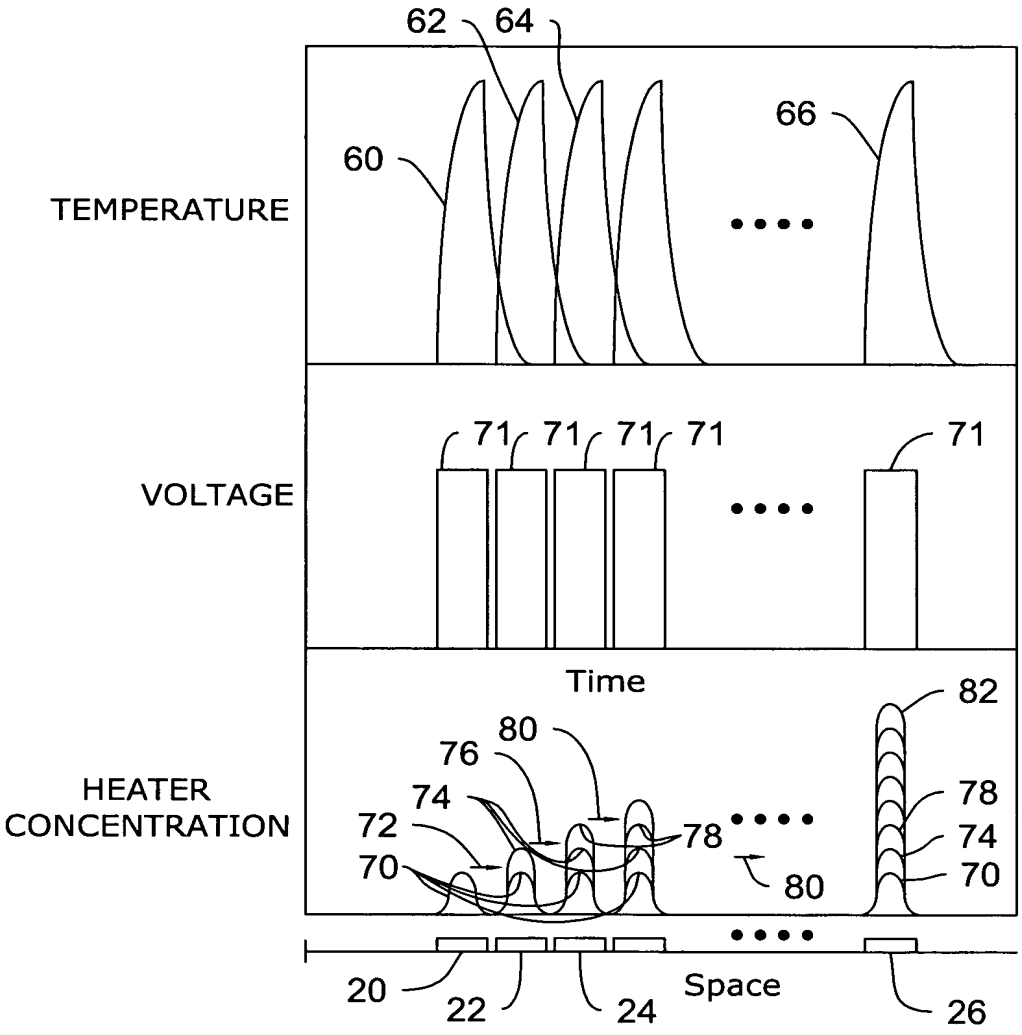
62
64
66
60
TEMPERATURE
71
71
71
71
71
VOLTAGE
Time
82
80
76
74
72
70
78
78
74
70
80
HEATER
CONCENTRATION
20
22
24
Space
26

Figure 7

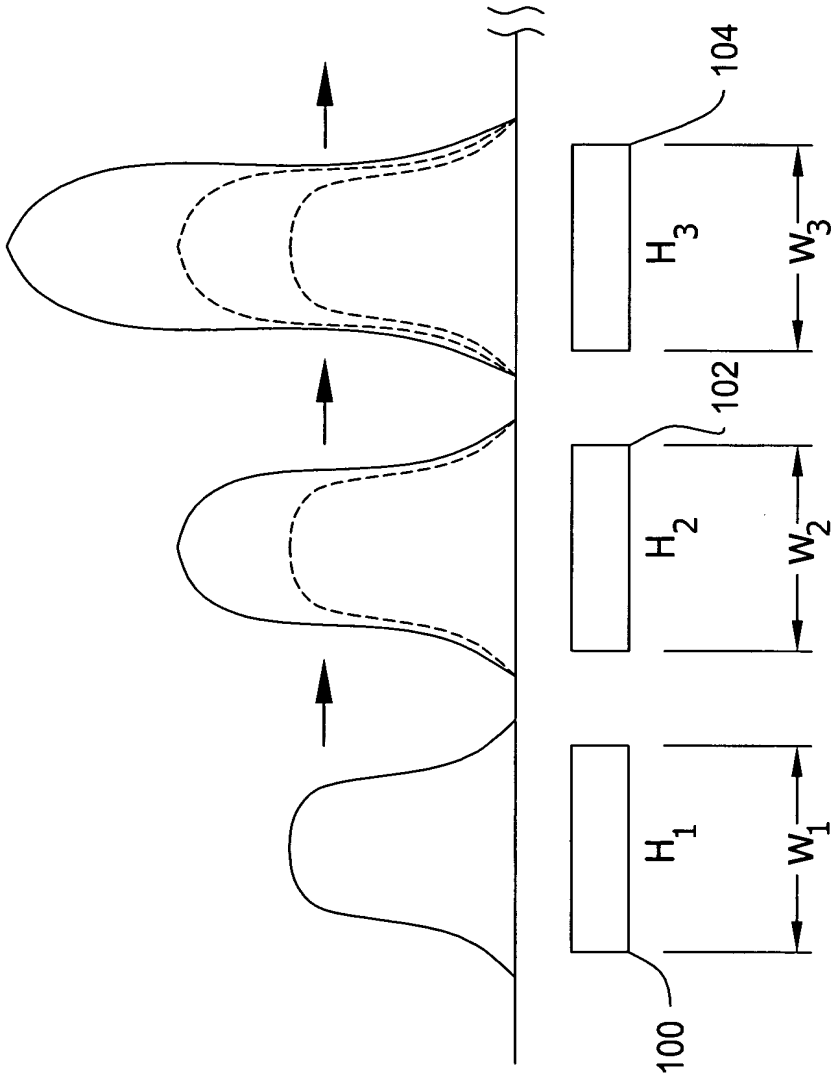

Figure 8

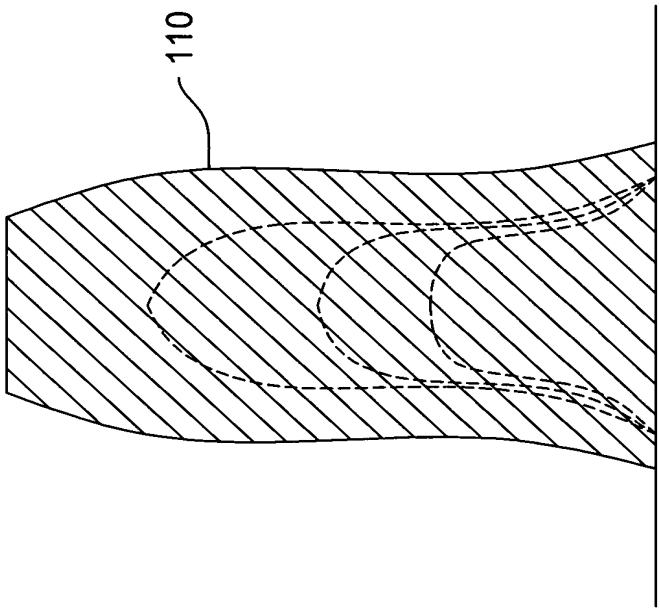

Figure 9

Table **Comparison of Detection Limits in pg/s (MDL) and Selectivities × 10^3 (SEL)**

		this work		ref 9 (without background correction)		ref 9 (with background correction)		ref 7[a] (echelle)		ref 8[b] (with background correction)	
element	wavelength, nm	MDL	SEL	MDL	SEL	MDL	SEL	MDL	SEL	MDL	SEL
N	174.2	7.0	6								
S	180.7	1.7	150								
Hg	184.9	0.1	3000								
C	193.1	0.5								53	
P	177.5	1.5	25								
C	247.9	2.6		2.7							
Si	251.6	7.0	90	9.3	1.6			58	3.9		
P	253.6			3.3	11			4.2	26		
Hg	253.7	0.1	5000	0.6	77			2.0	91		
Br	470.4			33	0.27	67	1.0	20	1.4	38	0.53
Br	478.6	75	19	34	0.60						
Cl	479.5	39	25	43	0.61	86	1.5			32	1.0
Cl	481.0							32	2.4		
H	486.1	2.2		16							
S	545.4	7.2	26	33	0.08	52	4.6	126	0.25	234	0.07
D	656.1	2.5	0.6[c]	7.4	0.19						
H	656.3	3.0		7.5						37	
F	685.6	40	30	20	0.57	180	11.4	17	3.5	11	0.82
O	777.2	75	25								

[a] Reference 7 uses peak width at base instead of peak width at half height to determine MDL, and the numbers have been adjusted accordingly for comparison. [b] Reference 8 uses 1σ instead of peak to peak (6σ) to measure noise for MDL, and their numbers have been adjusted accordingly for comparison. [c] Versus hydrogen.

Figure 10

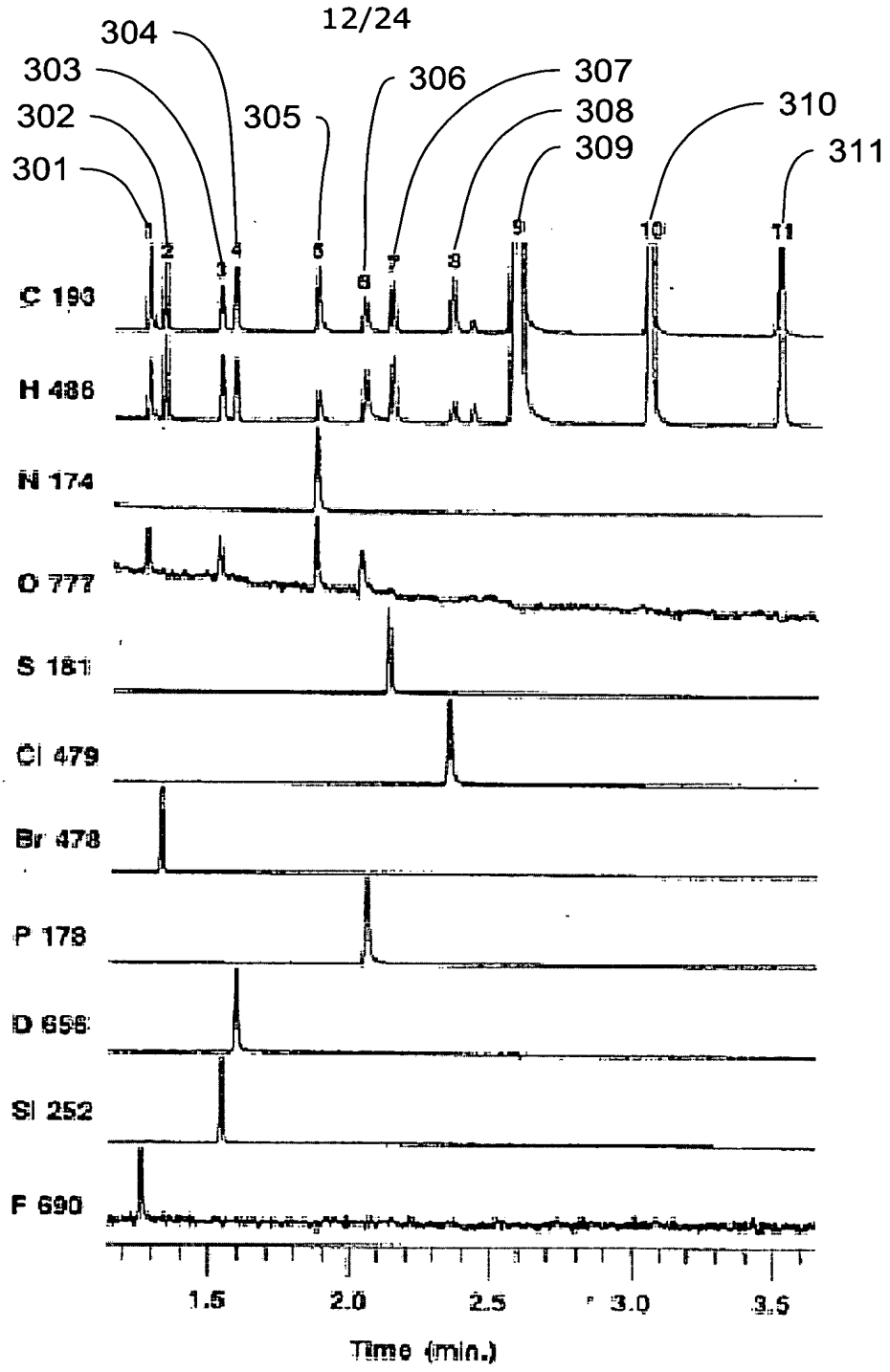
304
303
302
301
305
306
307
308
309
310
311
1
2
3
4
5
6
7
8
9
10
11
C 193
H 486
N 174
O 777
S 181
Cl 479
Br 478
P 178
D 656
Si 252
F 690
1.5
2.0
2.5
3.0
3.5
Time (min.)

Figure 11

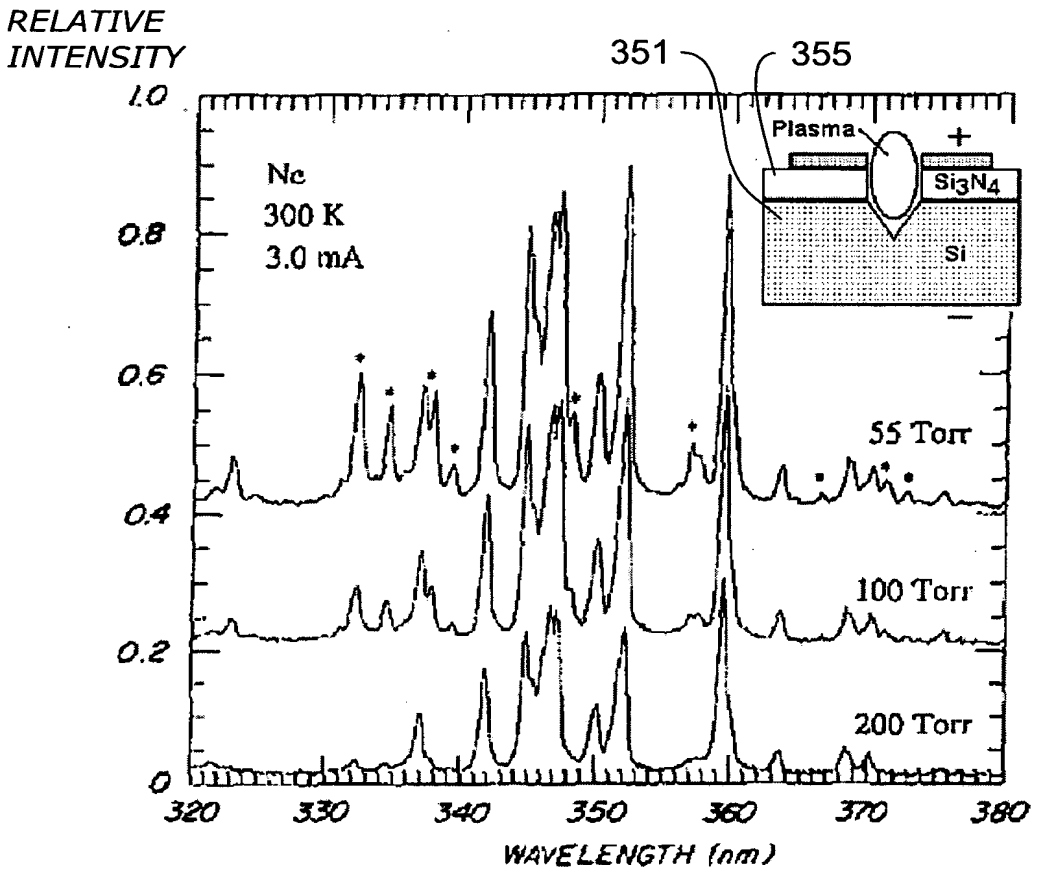
RELATIVE
INTENSITY
1.0
0.8
0.6
0.4
0.2
0
320
330
340
350
360
370
380
WAVELENGTH (nm)
Ne
300 K
3.0 mA
55 Torr
100 Torr
200 Torr
351
355
Plasma
+
Si3N4
Si
−

Figure 12

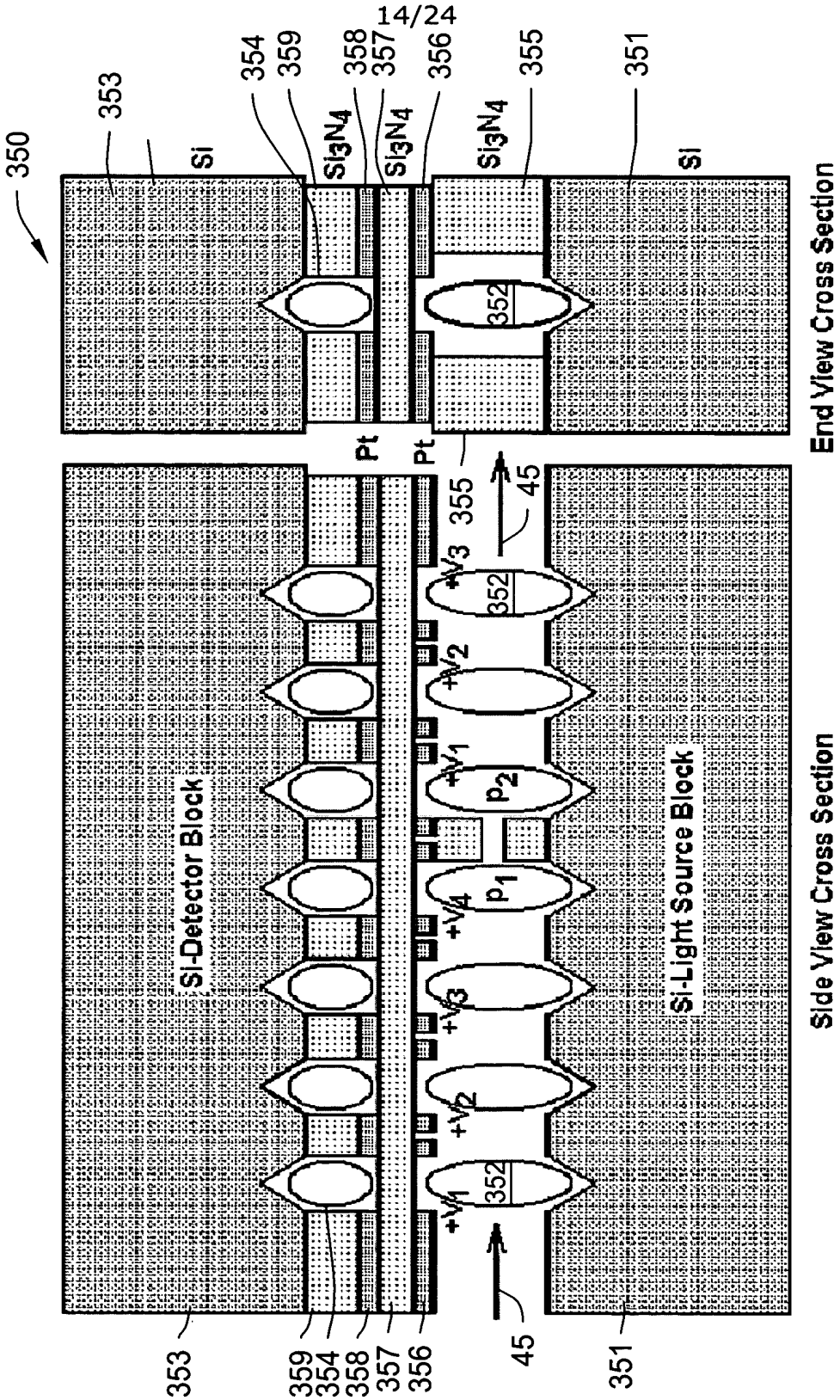
350
353
Si
354
359
358
357
356
355
351
Si3N4
Si3N4
Si3N4
Si
352
Pt
Pt
355
45
+V3
+V2
+V1
+V4
+V3
+V2
+V1
P2
P1
Si-Detector Block
Si-Light Source Block
End View Cross Section
Side View Cross Section
353
359
354
358
357
356
45
351

Figure 13

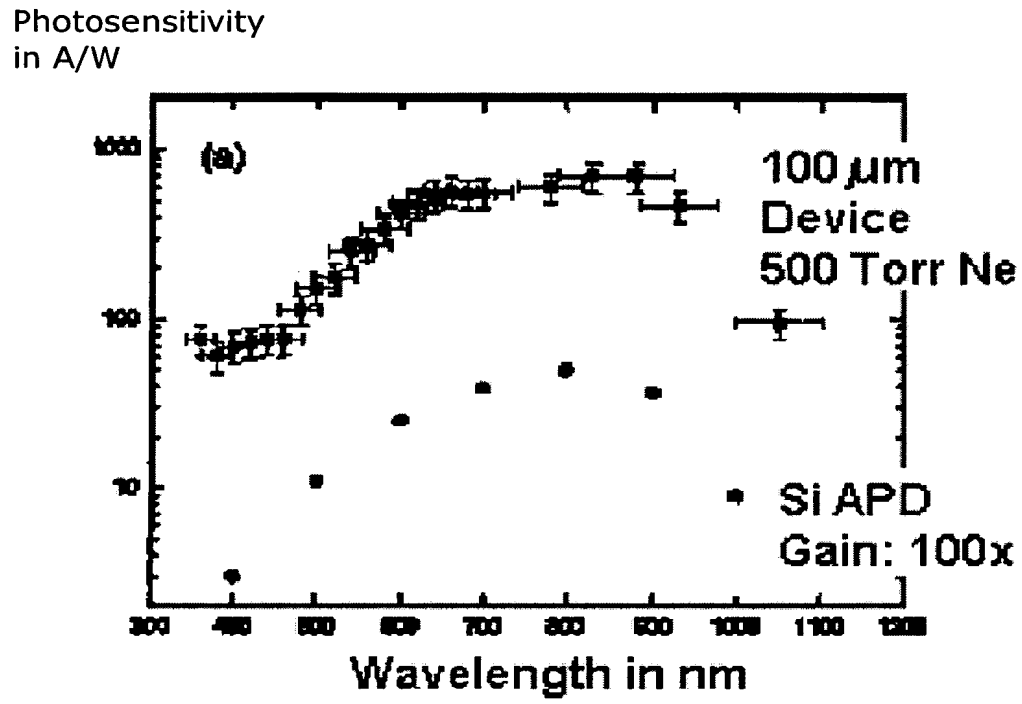
Photosensitivity
in A/W
(a)
100 µm
Device
500 Torr Ne
Si APD
Gain: 100x
Wavelength in nm

Figure 14

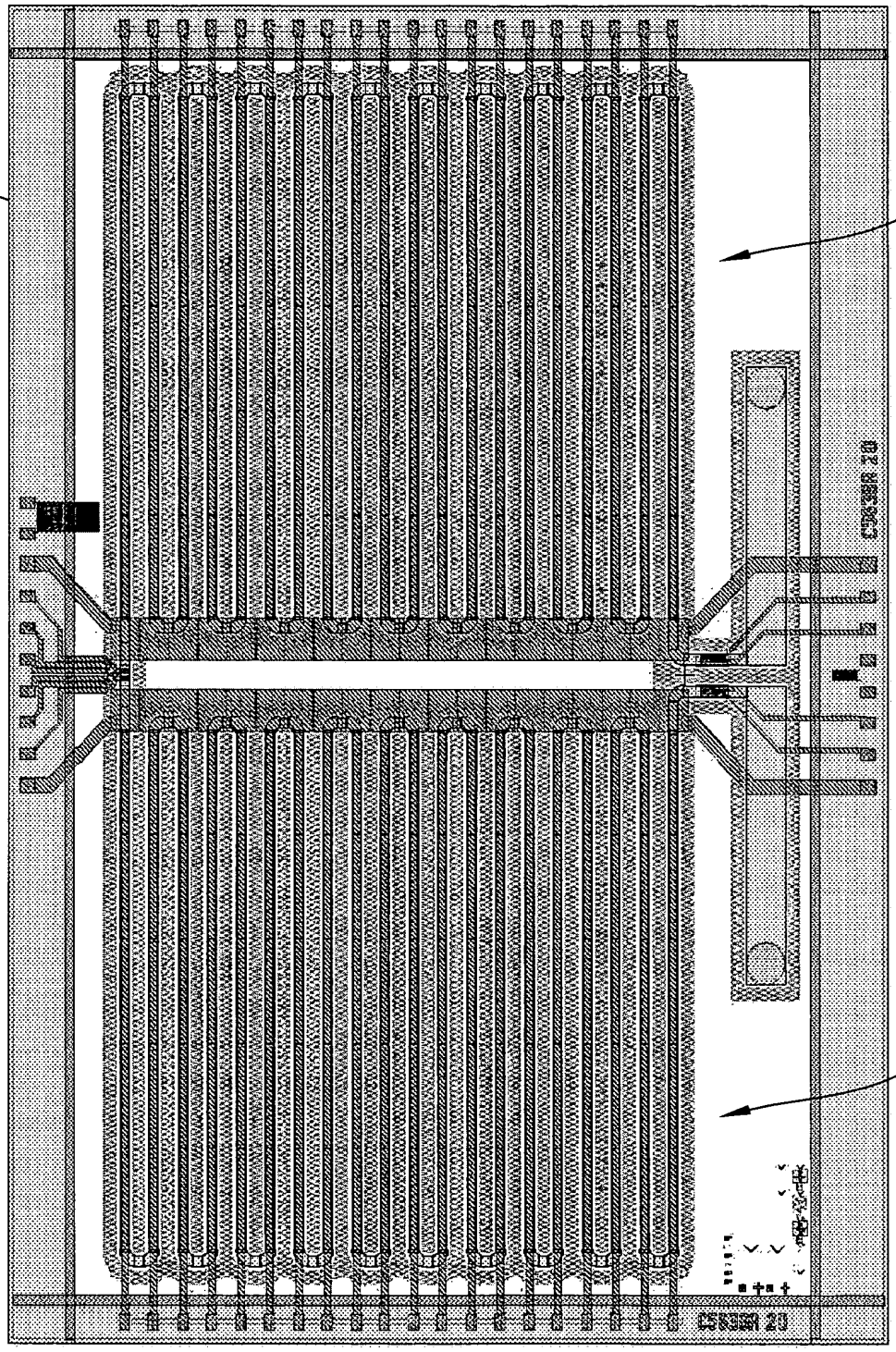

Figure 15

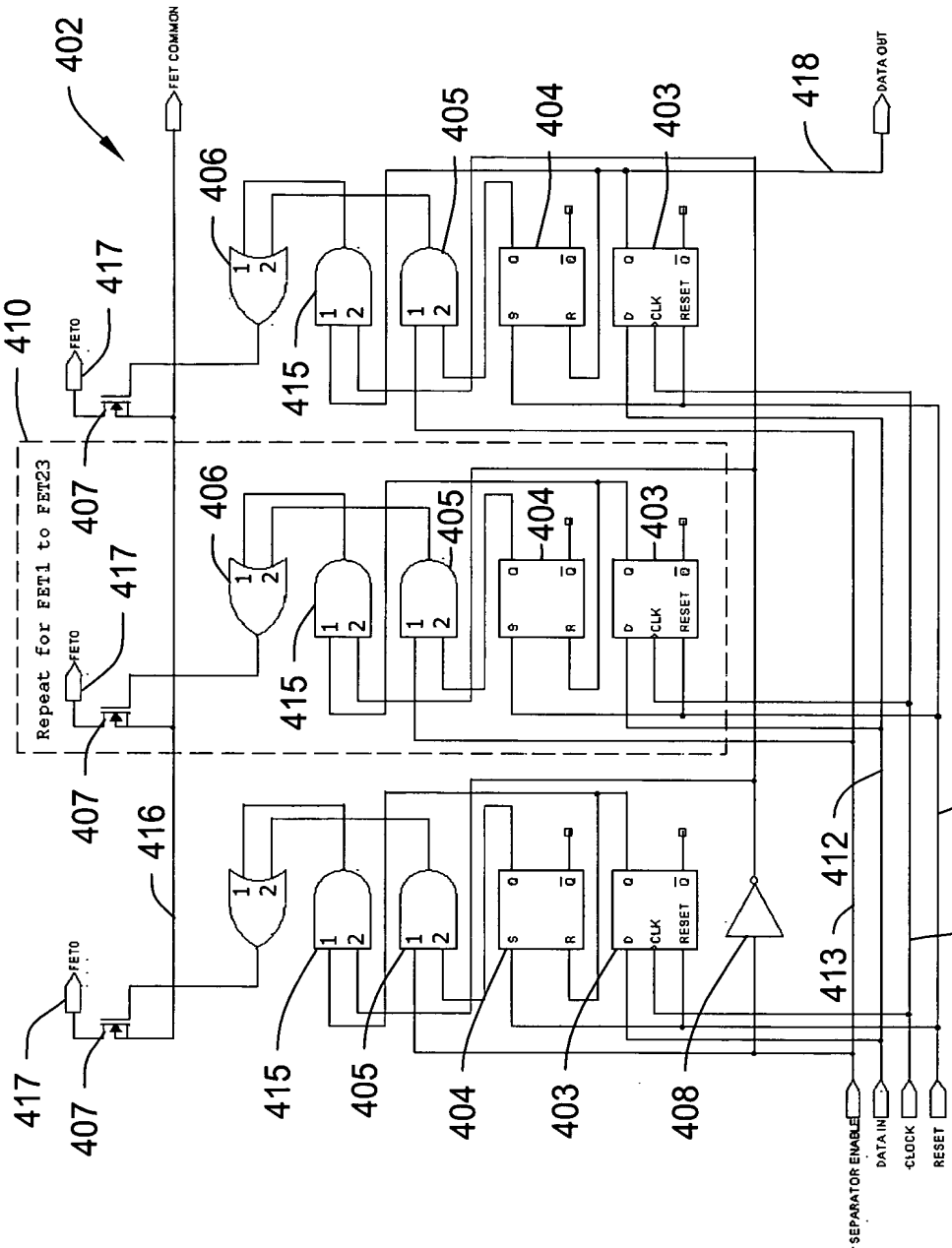
402
FET COMMON
DATA OUT
418
405
404
403
406
417
410
FET0
415
Repeat for FET1 to FET23
407
416
412
414
411
413
408
SEPARATOR ENABLE
DATA IN
CLOCK
RESET
CLK
RESET

Figure 16

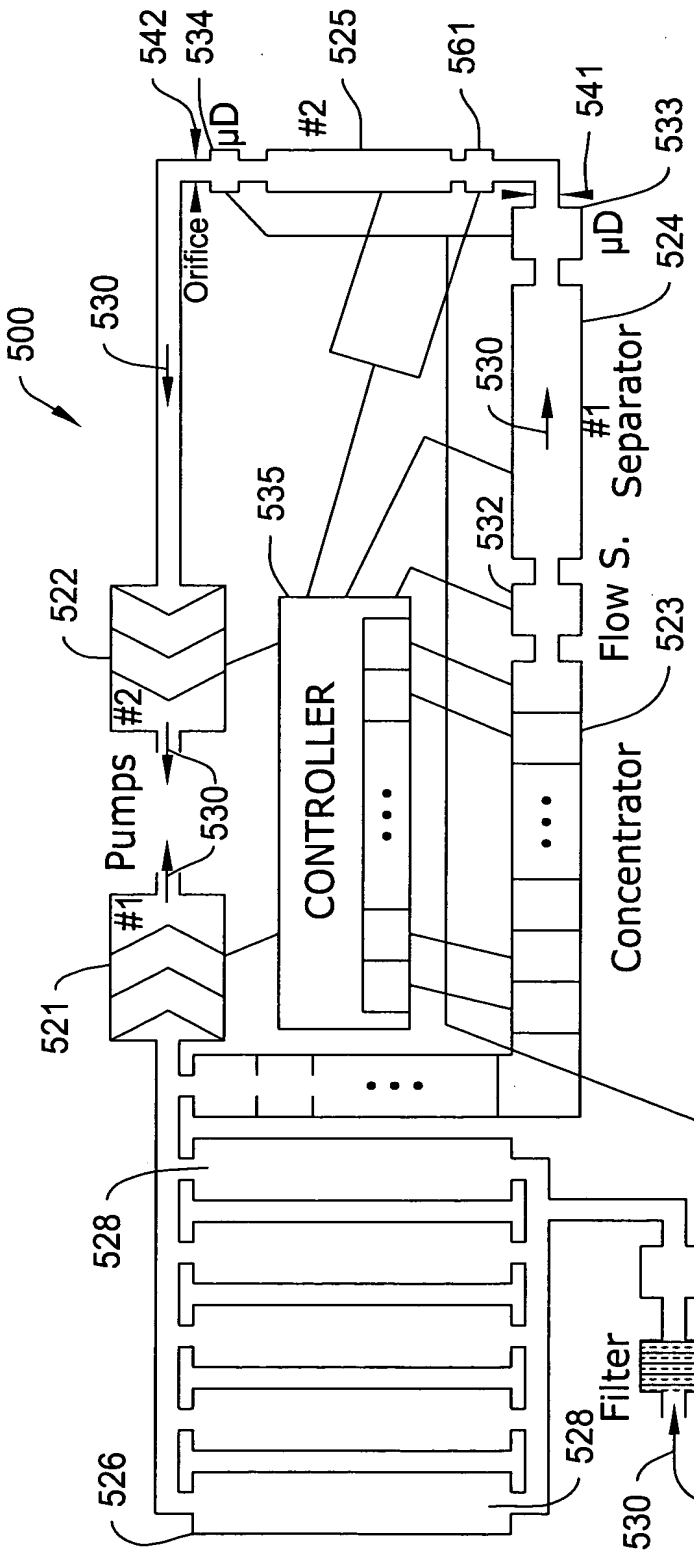
500
521
#1
Pumps
522
#2
530
CONTROLLER
535
Orifice
530
542
534
μD
#2
525
561
541
533
μD
524
530
#1
Flow S.
Separator
532
523
Concentrator
528
526
528
Filter
531
μD
527
530
Sample
Stream

Figure 17

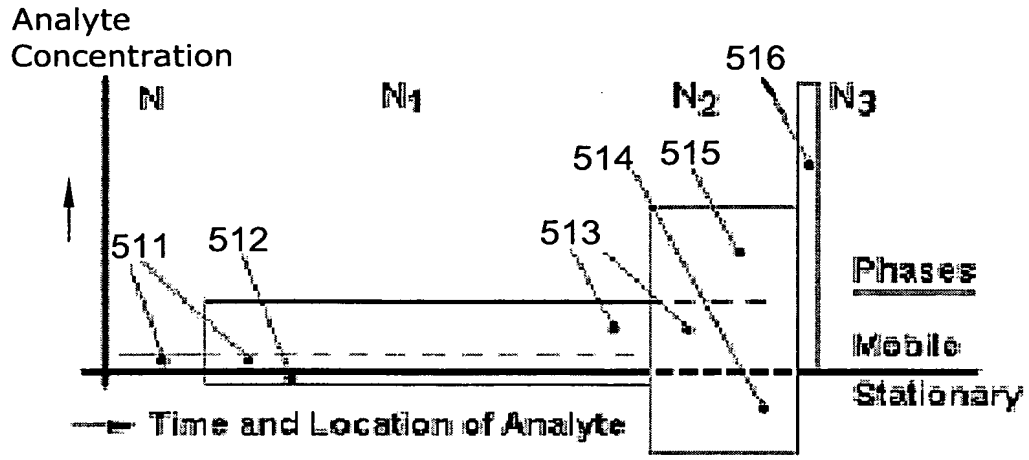

Figure 18

Analyte Masses = Film Length x Concentration

	N ppt	N_1 ppt	N_2 ppt	N_3 ppt
A	∞x1	500x100	5x10,000	1x 50,000
B	∞x1	1000x100	10x10,000	1x100,000
C	∞x1	5,000x100	50x10,000	1x500,000
D	∞x1	10,000x100	100x10,000	1x520,000+less
E	∞x1	100,000x100	1,000x10,000	10x1,000,000 (10^7)

Figure 19

Pres.Drop at 100 cm/s, 100x100 μm

No. of Elem. N1 -	Length L cm	Pres. Drop Δp psi	Peak P. Q watts
50	0.5	2.629	20.5
505	0.1	5.311	41.3
1010	0.1	10.621	82.6

Figure 20

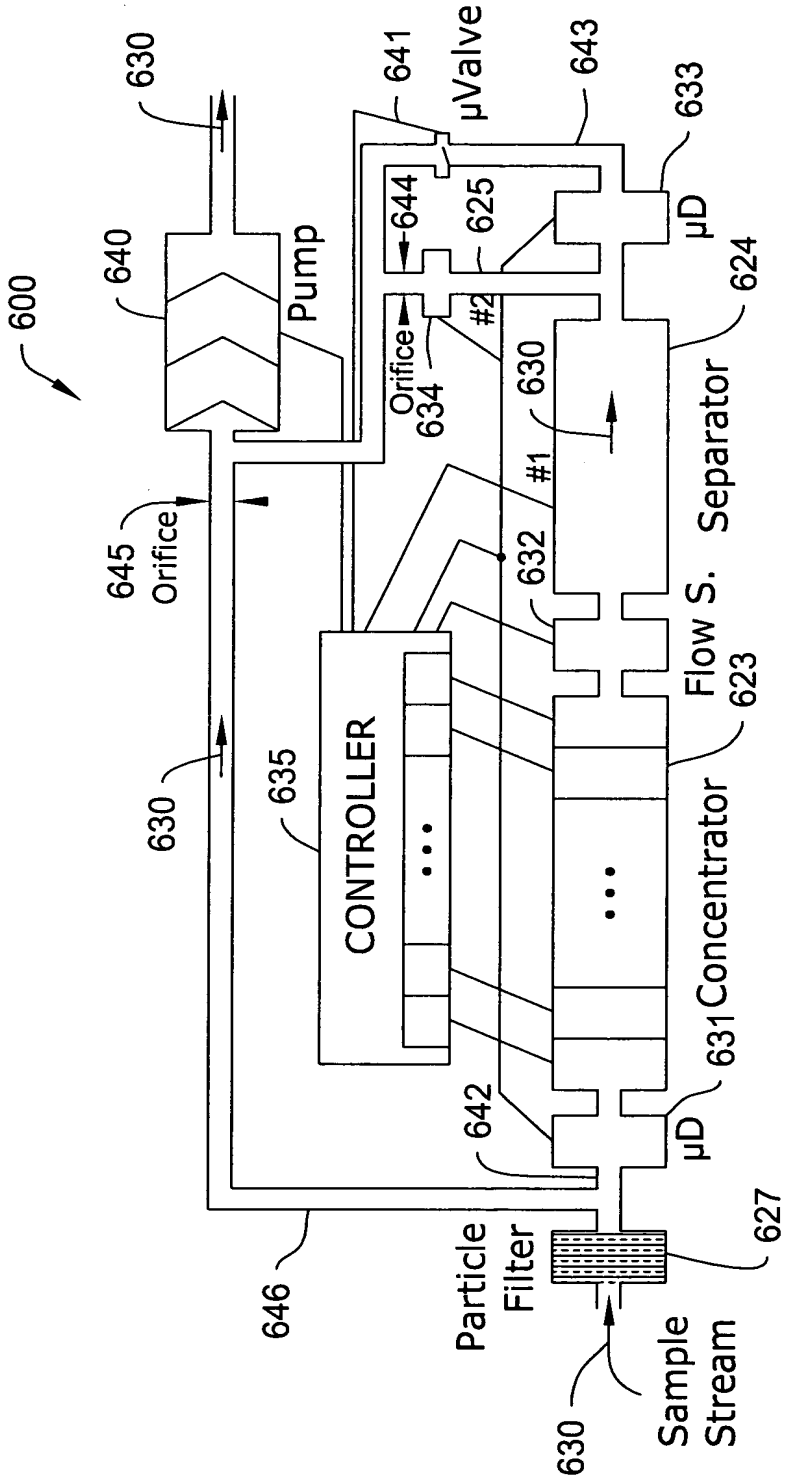
600
630
640
Pump
641
µValve
643
633
µD
644
625
624
Separator
Flow S.
623
Concentrator
631
µD
627
Sample
Stream
630
Particle
Filter
646
642
630
635
CONTROLLER
630
632
#1
630
634
Orifice
#2
645
Orifice

Figure 21

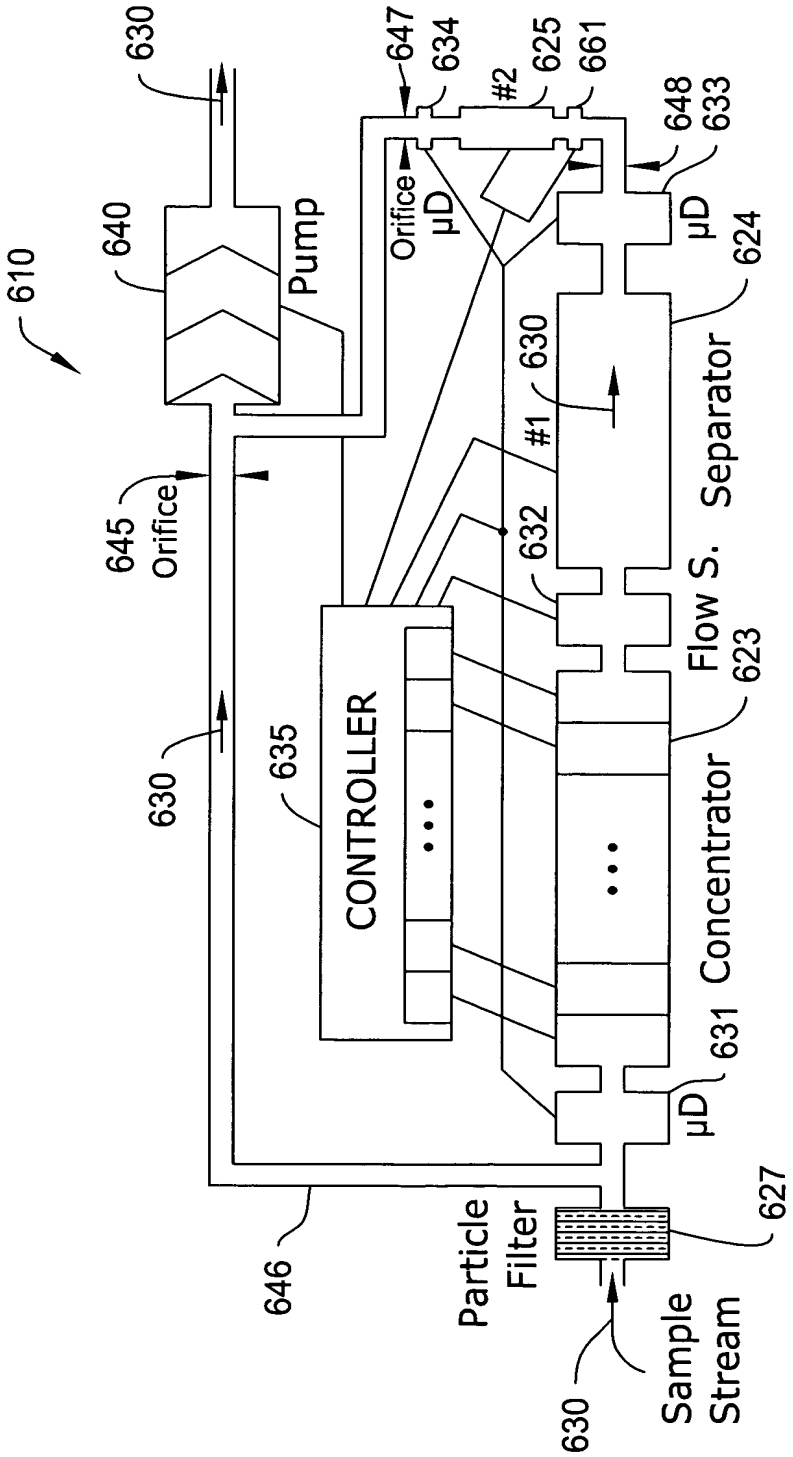
610
630
640
Pump
647
634
#2
625
661
648
633
Orifice
µD
µD
624
Separator
630
#1
645
Orifice
632
Flow S.
623
630
635
CONTROLLER
Concentrator
631
µD
627
646
Particle
Filter
630
Sample
Stream

Figure 22

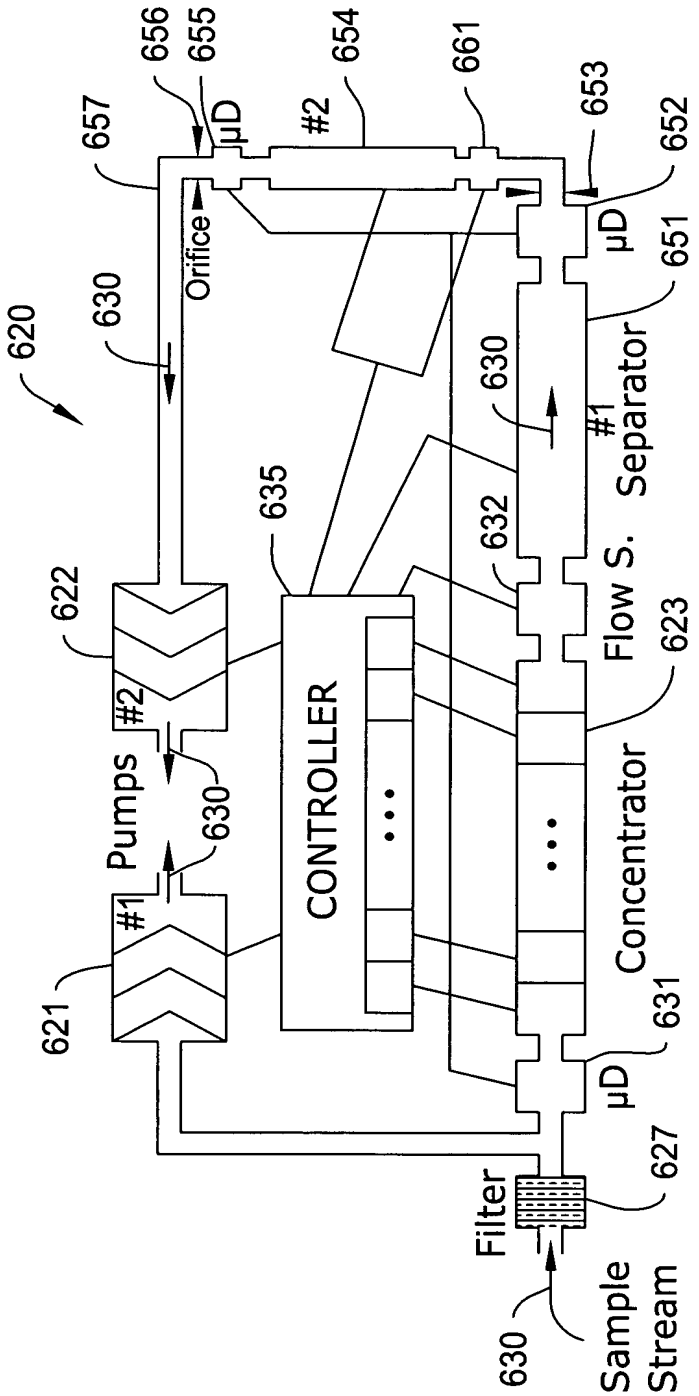
620
621
622
623
627
630
631
632
635
651
652
653
654
655
656
657
661
#1
#2
Pumps
CONTROLLER
Concentrator
Flow S.
Separator
Orifice
µD
Filter
Sample
Stream

Figure 23

Table: Design of µGc-µGC System on the Basis of a PHASED Structure

	v in cm/s	ID in cm	L in cm	s in µm	ℓ in mm	V in cm3/min	△p in psi
µGC-1	50	0.014	25	1	5	0.588	.671
µGC-2	250	0.007	10	0.15	2.5	0.588	5.365

	v	to	Half-Width △t	k=6 tR	k=0.2 v(optimal)	k=2 v(optimal)	k=2 R	k=0.2 △R(v-vo)
	cm/s	ms	ms	sec	cm/s	cm/s	-	%
µGC-1	50	500	20	3.00	68.8	56	8.76	2.5
µGC-2	250	40	2	0.24	149.2	118	8.00	6.2

Figure 24

Application Serial No. 10/672,483
Confirmation No. 8252
Formal REPLACEMENT DRAWINGS